

AMENDMENTS TO THE CLAIMS

Please amend the claims of the present application as set forth below. In accordance with the PTO's revised amendment format, a detailed listing of all claims has been provided. A status identifier is provided for each claim in a parenthetical expression following each claim number. Changes to the claims are shown by strikethrough (for deleted matter) or underlining (for added matter).

1. (currently amended): An apparatus for modifying an electrical audio signal for input to a sonic reproduction device that includes a speaker characterized by a plurality of individual responses which in combination define an overall response for the sonic reproduction device, each individual response comprising at least one of a frequency, time, phase or transient response, said apparatus comprising:

a plurality of modification filters having modification responses that simulate the plurality of individual responses, at least one said modification filter simulating an individual component of the speaker, the modification filters for receiving the electrical audio signal, modifying the electrical audio signal and providing the electrical audio signal to the sonic reproduction device; and

a plurality of adjustable parameters, each associated with at least one of the modification filters for allowing adjustments to the responses of the modification filters;

wherein the adjustments create a plurality of individual conjugate responses, each individual conjugate response associated with at least one of the plurality of individual responses.

2. (original): The apparatus of claim 1 wherein the plurality of individual responses of the sonic reproduction device are related to at least one of mechanical, acoustic and electromagnetic behavior of the sonic reproduction device.

3. (original): The apparatus of claim 1 wherein the filters are defined by digital signal processes.

4. (original): The apparatus of claim 1 wherein the filters are defined by analog circuitry.

5. (original): The apparatus of claim 1 wherein the plurality of modification filters are non-interacting.

6. (original): The apparatus of claim 1 wherein the plurality of modification responses combine to form an overall response that is a conjugate to the overall response for the sonic reproduction device.

7. (original): The apparatus of claim 1 wherein at least one of the modification filters comprises a cut-off filter and the parameters for adjusting the frequency response of the cut-off filter comprise peak frequency, amplitude and Q parameters.

1 8. (original): The apparatus of claim 7 wherein the peak frequency,  
2 amplitude and Q parameters modify the frequency response of the cut-off filter in  
3 at least one of the low and high frequency ranges.  
4

5 9. (original): The apparatus of claim 1 wherein at least one of the  
6 modification filters comprises a constant slope equalizer and the parameters for  
7 adjusting the frequency response of the constant slope equalizer comprise  
8 crossover frequency and boost shelf parameters.  
9

10 10.(original): The apparatus of claim 9 wherein the crossover frequency  
11 and boost shelf parameters modify the frequency response of the constant slope  
12 equalizer in at least one of the low and high frequency ranges.  
13

14 11.(original): The apparatus of claim 1 wherein at least one of the  
15 modification filters comprises a parametric notch filter and the parameters for  
16 adjusting the frequency response of the parametric notch filter comprise notch  
17 frequency, amplitude and Q parameters.  
18

19 12.(original): The apparatus of claim 1 wherein at least one of the  
20 modification filters comprises a parametric notch-boost filter and the parameters  
21 for adjusting the frequency response of the parametric notch-boost filter comprise  
22 notch frequency, amplitude and Q parameters.  
23  
24  
25

1 13.(currently amended): A sound compensation system for altering an  
2 electrical audio signal for input to a sonic reproduction device including a speaker  
3 and having associated behavioral characteristics, said system comprising:

4 a model of the sonic reproduction device having a plurality of filters that  
5 simulate at least one of the behavioral characteristics of the sonic reproduction  
6 device, each filter having an associated response that combine to define an overall  
7 response for the model, at least one said filter simulating an individual component  
8 of the speaker, each response comprising at least one of a frequency, time, phase  
9 or transient response; and

10 a controller that modifies the response of each of the plurality of filters to  
11 transform the filter into a conjugate filter having a responses that is conjugate to  
12 the original response of the filter.

13  
14 14.(original): The system of claim 13 wherein the behavior characteristics  
15 are defined by individual components of the sonic reproduction device.

16  
17 15.(original): The system of claim 13 wherein the behavioral characteristics  
18 are defined by groups of individual components of the sonic reproduction device.

19  
20 16.(original): The system of claim 13 wherein the filters are defined by  
21 digital signal processes and the controller comprises a computer.

22  
23 17.(original): The system of claim 13 wherein the filters are defined by  
24 analog circuits and the controller comprises adjustable circuit components.

25

1 18.(original): The system of claim 13 wherein the sonic reproduction  
2 device comprises a speaker and at least one of the plurality of filters comprises at  
3 least one associated adjustable parameter and the value of the parameter is  
4 calculated based on physical characteristics of the speaker.

5  
6 19.(currently amended): The system of claim 18 wherein the physical  
7 characteristics of the speaker comprises at least one of cone and coil mass, air  
8 volume, mechanical compliance, radiating area, damping, moving mass and motor  
9 characteristics.

10  
11 20.(original): The system of claim 13 wherein the sonic reproduction  
12 device comprises a speaker and at least one of the plurality of filters comprises at  
13 least one associated adjustable parameter and the value of the parameter is derived  
14 from a standard speaker model.

15  
16 21.(original): The system of claim 13 wherein at least one of the plurality  
17 of filters has at least one associated adjustable parameter and the value of the  
18 parameter is determined experimentally using standard test measurements.

19  
20 22.(original): The system of claim 13 wherein the controller is configured  
21 such that an adjustment in the setting of at least one other parameter.

22  
23 23.(original): The system of claim 22 wherein the sonic reproduction  
24 device comprises a speaker and the one parameter that modules the at least one  
25 other parameter relates to the magnet structure and voice coil of the speaker.

1  
2 24.(original): The system of claim 13 wherein the controller monitors the  
3 program conditions at the sonic reproduction device and sets at least one of the  
4 parameter values based on the program conditions.

5  
6 25.(original): The system of claim 24 wherein the program conditions  
7 comprise at least one of volume control settings, program level and bass content.

8  
9 26.(original): The system of claim 13 wherein one of the filters comprises a  
10 weighted compensation notch filter.

11  
12 27.(original): The system of claim 26 wherein the filter comprises a single-  
13 tuned weighted compensation notch.

14  
15 28.(original): The system of claim 26 wherein the filter comprises a  
16 double-tuned weighted compensation notch.

17  
18 29. (currently amended): A sound system comprising:  
19 a sonic reproduction device having associated mechanical, acoustic and  
20 electromagnetic behavioral characteristics;

21 a source for outputting an electrical audio signal to a model of the sonic  
22 reproduction device, the model having a plurality of filters that simulate at least  
23 one of the mechanical, acoustic and electromagnetic behavioral characteristics of  
24 the sonic reproduction device, at least one said filter simulating an individual  
25 component of a speaker of the sonic reproduction device, each filter having an

1 associated response comprising at least one of a frequency, time, phase or transient  
2 response, the model outputting the electrical audio signal to the sonic reproduction  
3 device; and

4 a controller that modifies the responses of the filters to transform the model  
5 into a conjugate model having a plurality of filters with responses that comprise  
6 conjugates to the original response of the filter.

7  
8 30. (original): The system of claim 29 wherein the filters are defined by  
9 digital signal processes.

10  
11 31. (original): The system of claim 29 wherein the filters are defined by  
12 analog circuitry.

13  
14 32. (original): The system of claim 29 wherein the plurality of filters are  
15 non-interacting.

16  
17 33. (original): The system of claim 29 wherein at least one of the filters  
18 comprises a cut-off filter and modifications to the frequency response of the cut-  
19 off filter comprise adjustments to peak frequency, amplitude and Q.

20  
21 34. (original): The system of claim 29 wherein at least one of the filters  
22 comprises a constant slope equalizer and modifications of the frequency response  
23 of the constant slop equalizer comprise adjustments to crossover frequency and  
24 boost shelf.

1 35.(original): The system of claim 29 wherein at least one of the filters  
2 comprises a parametric notch filter and modifications to the frequency response of  
3 the parametric notch filter comprise adjustments to notch frequency, amplitude  
4 and Q.

5  
6 36.(original): The system of claim 29 wherein at least one of the filters  
7 comprises a parametric notch-boost filter and modifications to the frequency  
8 response of the parametric notch-boost filter comprise adjustments to notch  
9 frequency, amplitude and Q.

10  
11 37.(currently amended): A method for modifying an electrical audio signal  
12 for input to a sonic reproduction device having a speaker and characterized by a  
13 plurality of individual responses which in combination define an overall response  
14 for the sonic reproduction device, each individual response comprising at least one  
15 of a frequency, time, phase or transient response, said method comprising the steps  
16 of:

17 simulating the plurality of individual responses with a plurality of filters,  
18 wherein at least one said filter simulates an individual component of the speaker;

19 adjusting the responses of the plurality of filters such that, for each filter,  
20 the adjusted response comprises a response that is a conjugate to one of the  
21 individual responses; and

22 inputting the electrical audio signal to the filters.

23  
24 38.(original): The method of claim 37 wherein the plurality of individual  
25 responses of the sonic reproduction device are related to at least one of a



1 mechanical, acoustic and electromagnetic behavior of the sonic reproduction  
2 device.

3  
4 39.(original): The method of claim 37 wherein the plurality of filters are  
5 non-interacting.

6  
7 40.(original): The method of claim 37 wherein the plurality of adjusted  
8 responses combine to form an overall response that is a conjugate to the overall  
9 response for the sonic reproduction device.

10  
11 41.(original): The method of claim 37 wherein at least one of the filters  
12 comprises a cut-off filter and the step of adjusting the frequency response of the  
13 cut-off filter comprises the step of setting at least one of peak, frequency,  
14 amplitude and Q.

15  
16 42.(original): The method of claim 37 wherein at least one of the filters  
17 comprises a constant slope equalizer and the step of adjusting the frequency  
18 response of the constant slope equalizer comprises the step of setting at least one  
19 of crossover frequency and boost shelf.

20  
21 43.(original): The method of claim 37 wherein at least one of the filters  
22 comprises a parametric notch filter and the step of adjusting the frequency  
23 response of the parametric notch filter comprises the step of setting at least one of  
24 notch frequency, amplitude and Q.

25

1 44.(original): The method of claim 37 wherein at least one of the filters  
2 comprises a parametric notch-boost filter and the step of adjusting the frequency  
3 response of the parametric notch-boost filter comprises the step of setting at least  
4 one of notch frequency, amplitude and Q.

5  
6 45.(currently amended): A method of altering an electrical audio signal for  
7 input to a sonic reproduction device having a speaker and associated behavior  
8 characteristics, said method comprising the steps of:

9 simulating at least one of the behavioral characteristics of the sonic  
10 reproduction device with a plurality of filters, at least one said filter simulating an  
11 individual component of the speaker, each filter having an associated response  
12 comprising at least one of a frequency, time, phase or transient response; and

13 for each of the filters, modifying the response of the filter to transform the  
14 filter into a conjugate filter having a response that comprises a conjugate to the  
15 original response of the filter.

16  
17 46.(original): The method of claim 45 wherein the behavioral  
18 characteristics are defined by individual components of the sonic reproduction  
19 device.

20  
21 47.(original): The method of claim 45 wherein the behavioral  
22 characteristics are defined by groups of individual components of the sonic  
23 reproduction device.  
24  
25

1 48.(original): The method of claim 45 wherein the sonic reproduction  
2 device comprises a speaker and at least one of the plurality of filters has at least  
3 one associated adjustable parameter and the step of modifying the response of the  
4 filter comprises the steps of:

5 calculating the value of the at least one adjustable parameter value based on  
6 the physical characteristics of the speaker; and

7 setting the parameter to the calculated value.  
8

9 49.(currently amended): The method of claim 48 wherein the physical  
10 characteristics of the speaker comprises at least one of cone and coil mass, air  
11 volume, mechanical compliance, radiating area, damping, moving mass and motor  
12 characteristics.  
13

14 50.(original): The method of claim 45 wherein the sonic reproduction  
15 device comprises a speaker and at least one of the plurality of filters has at least  
16 one associated adjustable parameter and the step of modifying the response of the  
17 filter comprises the steps of:

18 deriving the at least one adjustable parameter from a standard speaker  
19 model; and

20 setting the parameter to the derived value.  
21

22 51.(original): The method of claim 45 wherein at least one of the plurality  
23 of filters has at least one associated adjustable parameter and the step of modifying  
24 the response of the filter comprises the steps of:  
25

1 determining the at least one adjustable parameter experimentally using  
2 standard test measurements; and

3 setting the parameter to the determined value.  
4

5 52.(original): The method of claim 48, 50 or 51 further comprising the step  
6 of modulating the setting of at least one parameter in response to the setting of  
7 another parameter.  
8

9 53.(original): The method of claim 48, 50 or 51 further comprising the  
10 steps of:

11 monitoring at least one program condition at the sonic reproduction device;  
12 and

13 setting at least one of the parameter values based on the at least one  
14 program condition.  
15

16 54.(original): The method of claim 53 wherein the program conditions  
17 comprise at least one of volume control setting, program level and bass content.  
18